# Technology Delivery

# Technology Delivery Annual Report

## Fiscal Year 2003

**Industrial Technologies Program**
Boosting the productivity and competitiveness of U.S. industry
through imporvements in energy and environmental performance

U.S. Department of Energy
Energy Efficiency and Renewable Energy

# Industrial Technologies Program — Boosting the Productivity and Competitiveness of U.S. Industry

Industry consumes 33 percent of all energy used in the United States. By developing and adopting more energy efficiency technologies, U.S. industry can boost its productivity and competitiveness while strengthening national energy security, improving the environment, and reducing emissions linked to global climate change.

The U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) works in partnership with U.S. industry to increase the efficiency of energy and materials use, both now and in the future. Through an innovative strategy known as Industries of the Future (IOF), EERE's Industrial Technologies Program (ITP) seeks to improve the energy intensity of the U.S. industrial sector through a coordinated program of research and development (R&D), validation, and dissemination of energy efficiency technologies and operating practices. ITP develops, manages, and implements a balanced portfolio that addresses industry requirements throughout the technology development cycle. The primary long-term strategy is to invest in high-risk, high-return R&D. Investments are focused on technologies and practices that provide clear public benefit but for which market barriers prevent adequate private-sector investment.

The IOF strategy maximizes the energy and environmental benefits of ITP's process-specific technology investments by forming collaborative partnerships with energy–intensive industries. These collaborations aim to effectively plan and implement comprehensive R&D agendas and help disseminate and share best energy management practices throughout the United States. The IOF public-private partnerships also facilitate voluntary efforts, such as the President's Climate VISION initiative, to encourage industry and government to reduce greenhouse gas emissions. ITP focuses its resources on a small number of energy-intensive materials and process industries that account for over 75 percent of industrial energy consumption:

- Aluminum
- Chemicals
- Forest Products
- Glass
- Metal Casting
- Mining
- Petroleum Refining
- Steel

ITP also conducts R&D projects on enabling technologies that are common to many industrial processes such as industrial energy systems, combustion, materials, and sensors and process control systems. In addition, ITP funds technical assistance activities to stimulate near-term adoption of best energy-saving technologies and practices within industry. These activities include plant assessments, tool development and training, information dissemination, and showcase demonstrations.

New technologies that use energy efficiently also lower emissions and improve productivity. By leveraging technical and financial resources of industry and government, the IOF partnerships have generated significant energy and environmental improvements that benefit the nation and America's businesses. Energy-intensive industries face enormous competitive pressures that make it difficult to make the necessary R&D investments in technology to ensure future efficiency gains. Without a sustained commitment by the private and public sectors to invest in new technology R&D and deployment, the ability to close the gap between U.S. energy supply and demand will be severely compromised.

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U.S. manufacturing industries face significant challenges in maintaining competitiveness in global markets. One way for industry to meet this challenge is by using energy more efficiently. In fact, industry can save enormous amounts of energy today by implementing off-the-shelf technologies and best practices in energy management. The Industrial Technologies Program (ITP), through its Technology Delivery program element, funds activities that stimulate near-term investment in energy-saving technologies and practices. Improvements in energy efficiency reduce operating and maintenance costs, and also eliminate waste, improve product quality, increase capacity, and reduce environmental impact.

About 60 percent of the total primary energy associated with the industrial sector is lost prior to use in specific industrial unit processes. Energy losses occur during the generation of power at off-site utilities and during the transport of fuels to the plant site. Energy losses also occur within plant boundaries during the generation and distribution of steam and electricity, during process heating and other energy conversion processes, and during the actual unit process operations. Huge opportunities exist for companies to improve the bottom line by reducing these energy losses, a task that can be facilitated by the products and services available through Technology Delivery.

## A Successful Partnership with Industry

The U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) leads the federal role in developing advanced energy efficiency and environmentally friendly industrial technologies. Technology Delivery is a component of the overall EERE strategy and contributes to the goals outlined in the National Energy Policy. Its objectives are to provide near-term technologies and practices to industry that complement the longer-term R&D. Technology Delivery activities and resources support all of EERE's Industries of the Future (IOFs).

Through Technology Delivery, ITP funds technical assistance activities to stimulate near-term adoption of the best energy-saving technologies and practices within industry. These activities include plant energy assessments, software tool development and related training, information and technology dissemination, and support for showcase demonstrations and regional energy events. To reach as many plants as possible, ITP also pursues a replication strategy. Part of this strategy includes the creation of a network of EERE Allied Partners – true public-private partnerships involving entities that have the ability to reach large numbers of end users. Allied Partners deliver energy efficiency information, products, and services; support the use of best practices in energy management; promote the replication of energy-saving strategies; and encourage technical professionals to participate in software qualification training and apply this knowledge with end users.

The ITP team is a motivated, mission-driven group consisting of about 20 technology managers at DOE Headquarters, about 10 project officers in Golden, CO and Morgantown, WV, and seven Regional Office staff located at the six DOE Regional Offices. Team unity and mission are the hallmarks of the geographically split team, and the tight working relationship is a testament to the "can do" attitude of the entire team.

## Achieving Energy Savings: Portfolio Strategy

Industry can save enormous amounts of energy today by implementing off-the-shelf technologies and energy management practices. The greatest challenges to achieving these savings are increasing industry's awareness of the benefits of energy efficiency, and of the products and services offered by EERE. Another major challenge is to impact as many of the most energy-intensive manufacturers as possible. The major components of Technology Delivery's strategy for addressing these challenges include:

- **Public-Private Partnerships** with end users, equipment vendors, energy suppliers, trade and technical associations, and others to disseminate information and promote replication of energy efficiency methodologies and results;
- **Assessments** to uncover inefficiencies in overall plant operations and in motor, steam, compressed air, pumping, and process heating systems, and to replicate these findings within end-user companies and within relevant industrial sectors;
- **Tool Development and Training** to enable companies to self-assess plant utility systems and train plant managers and others to optimize energy use for specific energy systems or across an entire plant with little or no capital investment;
- **Qualified Specialists and Instructors** to engage industrial suppliers and consultants in greatly increasing the awareness and use of BestPractices software tools
- **Showcase Demonstrations and Energy Events** to highlight the benefits of energy efficiency and renewable energy technologies;
- **Emerging Technologies and Verification/Validation** activities to support independent, unbiased confirmation of the energy, economic, productivity, and environmental benefits of innovative technologies;
- **Outreach** to provide information about proven energy management practices and technologies to create awareness and encourage action that can help companies achieve immediate energy savings; and
- **Metrics Development** to evaluate the impact of the strategy on industrial energy use.

## FY 2003 Highlights

- **Public-Private Partnerships** - Completed 16 Allied Partner (AP) agreements.
- **Assessments** - Completed eight plant-wide assessments (findings/methodology were replicated by four companies at sister plants); completed 691 Industrial Assessment Center assessment days at 612 individual plants.
- **Tool Development** - Released new process heating (PHAST) and steam assessment (SSAT) software tools; continued development of fan system assessment tool (FSAT) and the plant energy profiler tool.
- **Tool Training** - Completed 77 End-User Workshops, with 1,777 end users trained in use of EERE software tools; completed nine Qualified Specialists Workshops, with 64 participants passing the exam to become Qualified Specialists for using BestPractices software tools.
- **Showcase Demonstrations and Energy Events** - Participated in Texas Technology Showcase, Saving Water event in Denver, and Nevada Mining Energy Solutions event.
- **Emerging Technologies and Verification/Validation** - Continued four projects implemented as a result of the Emerging Technologies Deployment solicitation issued in FY 2000. These projects involve the production of polyurethane foam; a field test of the in-line, fluidized bed, rapid heat treatment system; a large-scale evaluation of nickel aluminide rolls in a heat-treating furnace; and improved taconite processing plant efficiency.
- **Outreach** - Issued over 50 outreach documents and maintained an up-to-date Web site; recorded over 800,000 page views, over 1 million file downloads, and over 1 million PDF downloads from the BestPractices and IAC Web sites; and created the Energy Savers Web site.
- **Metrics Development** - Impacted about 1,200 additional manufacturing and mining plants by actions taken in FY 2003; energy savings from actions undertaken in FY 2002 were estimated to be over 80 trillion Btu.

# TECHNOLOGY DELIVERY OVERVIEW

The mission of the Industrial Technologies Program (ITP) is to improve the energy intensity of the U.S. industrial sector through a coordinated program of research and development, validation, and dissemination of energy efficiency technologies and practices. ITP partners with industry, its equipment manufacturers, and other stakeholders to reduce our nation's reliance on foreign energy sources, reduce environmental impacts, increase the use of renewable energy sources, and improve industrial competitiveness. Technology Delivery is an element within ITP; the other elements are Chemical and Allied Processes, Industrial Energy Systems, Materials, Sensors and Automation, and Metals and Mining.

Technology Delivery supports the mission of ITP, targeting the most energy-intensive industries and plants in the United States. Technology Delivery develops, implements, and disseminates best practices in energy management that realize the best energy efficiency and pollution prevention options from a system and life-cycle-cost perspective.

The major elements within Technology Delivery are as follows:

**Public-Private Partnerships** – As part of a delivery strategy for improving U.S. energy efficiency, EERE has supported an Allied Partnership initiative to help disseminate information to the industrial, commercial, residential, and government sectors. Allied Partners include equipment manufacturers and suppliers; trade, technical, and other national associations; large manufacturing companies; utilities; and public, non-profit organizations. These entities have the ability to deliver energy efficiency information, products, and services; support the use of best practices in energy management; promote replication of energy-saving strategies; and encourage technical professionals to participate in software qualification training. Appendix A presents a full list of EERE Allied Partners.

**Assessments** – Through competitive solicitations, Technology Delivery conducts cost-shared (up to $100,000) plant-wide assessments of large plants with high potential for energy savings and replication. In addition, free energy audits are available to small and medium-size companies (fewer than 500 employees on-site, annual sales of less than $100 million, and an annual energy bill of less than $2 million) through 26 Industrial Assessment Centers (IACs) located throughout the country. Technology Delivery promotes and encourages replication of assessment results and methodologies as a key strategy.

**Tool Development** – Technology Delivery has developed product-neutral software tools to assess energy-saving opportunities in major plant utility systems, including compressed air, pumps, motors, process heating, and steam. Tool development is led by collaborations among companies and trade associations with assistance from the National Laboratories. These tools and others are distributed free of charge to manufacturing companies through the ITP Clearinghouse and during tool training sessions (see below) and can be downloaded from the ITP Web site. The tools are regularly re-evaluated for any necessary upgrades.

**Training** – Technology Delivery, often in cooperation with Allied Partners, provides a range of training opportunities. These include overview sessions designed to increase awareness of energy-savings opportunities, focused sessions to teach end users how to apply a given software tool, and qualified specialist sessions designed to develop a cadre of industry-based specialists with a comprehensive knowledge of specific software tools.

**Showcase Demonstrations and Energy Events** – Technology Delivery helps industry highlight the benefits of energy efficiency and renewable energy technologies by participating in EERE-wide public events to demonstrate how a comprehensive approach to improving plant operations can increase productivity, cost and energy savings, and environmental benefits.

**Emerging Technologies and Technology Verification/Validation** – Technology Delivery also validates and demonstrates emerging technologies and encourages corporate energy management strategies. Technology verification/validation is an independent assessment by unbiased third parties to validate the energy, economic, productivity, and environmental benefits of emerging technologies under real-use conditions.

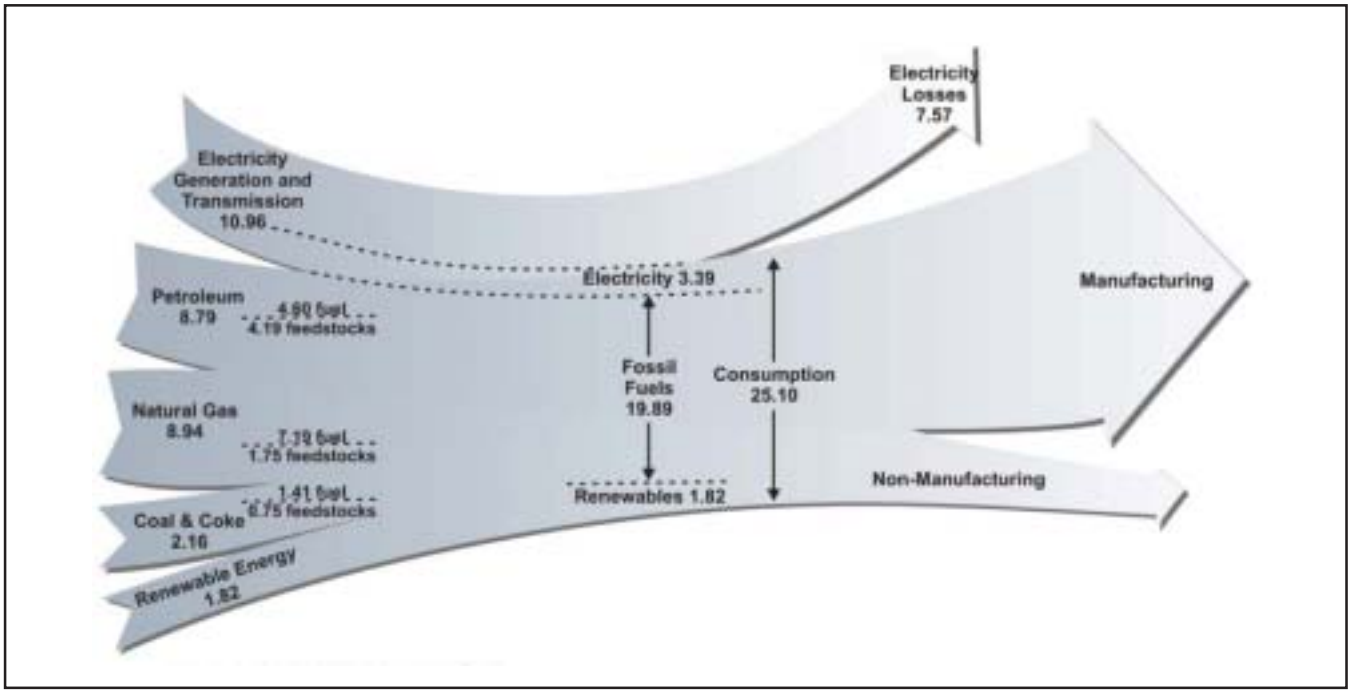
**Outreach** – Outreach and communication products heighten industry awareness of technologies and practices that, if implemented, generate near-term energy benefits. Products include case studies (for plant-wide assessments as well as other efficiency improvements), tip sheets on plant utility systems, the quarterly *Energy Matters* newsletter, resource CD-ROMs for particular industrial sectors, brochures, and reference guides. All of these products are downloadable from the ITP Web site or accessed through the ITP Clearinghouse staff. The staff at the Clearinghouse also provides technical advice about ITP's products and services (see "How to Get Involved and Contact Information" at the end of this document).

**Metrics Development** – Energy savings are the key metric by which Technology Delivery measures its impact on industrial energy use. Technology Delivery has developed a methodology for estimating the impact of the BestPractices and IAC activities – including the energy savings resulting from assessments, as well as use of the tools, training, printed materials, and the technical assistance provided by the Clearinghouse. Technology Delivery also maintains a database that tracks all non-R&D impacts of the Industrial Technologies Program.

## Energy Use

In 2001, industry consumed 33 quads, or over one-third of the 96 quads consumed in the United States. Approximately 8 quads are lost during power generation and transmission before the electricity arrives at industrial plants. This represents an opportunity for combined heat and power technologies, microturbines, and other cogeneration technologies located within plant boundaries. Natural gas, petroleum products, and electricity comprise the major energy sources used to power factories, farms, mining, and construction operations. Exhibit 1 summarizes the energy flows for the industrial sector.

**Exhibit 1**
**Energy Use in U.S. Industry**



Manufacturing plants use energy to generate steam, for direct process heating and cooling, to power machine drives and electrolytic systems, to generate power, and to heat, cool, and light facilities (see Exhibit 2). In 2001, energy consumption in the U.S. manufacturing sector (which excludes the construction, mining, and agriculture industries that are included in the larger industrial sector) totaled 24,658 trillion Btu (24.7 quads).

As indicated in the energy footprint for manufacturing (Exhibit 3), energy losses occur during power generation at off-site utilities, during fuel transport to the plant site, within plant boundaries during steam and electricity generation and distribution, during process heating and other energy conversion processes, and during the actual process-specific unit operations.

These on-site losses are very large; of the 17,774 trillion Btu entering manufacturing plants, only 10,699 trillion Btu are available for process-specific industrial operations such as chemical reactors, glass furnaces, and wood pulping units.

**Exhibit 2**
**U.S. Manufacturing Energy End Uses**

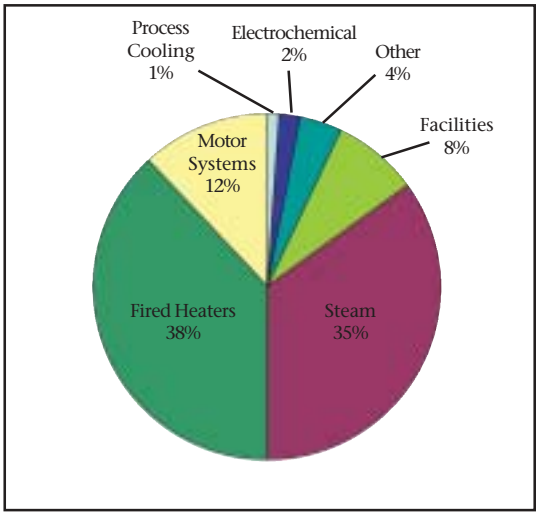
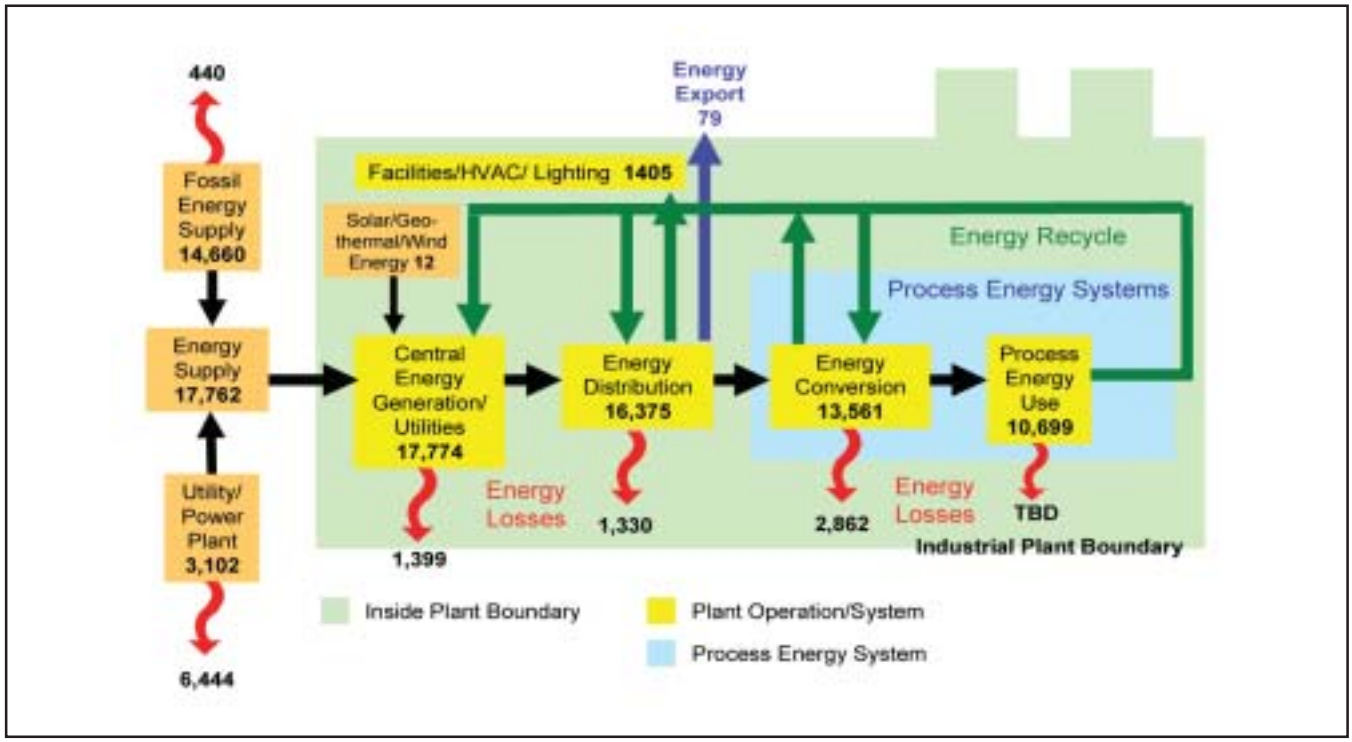



**Exhibit 3**
**Energy Footprint for U.S. Manufacturing**



# THE CHALLENGE

Industry can save enormous amounts of energy today by implementing low- or no-cost off-the-shelf technologies and energy management practices. Only 40 percent of industry's primary energy requirements is consumed in manufacturing operations. Losses inside the plant boundary are substantial and companies can realize significant energy efficiency gains from improvements in the operation of in-plant energy generation and distribution systems, process heating equipment, and other plant utility systems. Unfortunately, many industrial plants do not realize that quick and sizeable savings can result from relatively simple, inexpensive changes to the traditional modes of operation.

A key challenge for ITP's Technology Delivery effort is to make manufacturers aware that energy conservation can reduce operating and maintenance costs, eliminate waste, improve product quality, increase capacity, and reduce environmental impact. When energy costs are low relative to other production costs, investments in energy efficiency projects typically decline. Upper management is not always aware of the real operational costs of a proposed energy efficiency change and must be convinced that they can save millions of dollars by implementing energy-saving projects. Based on the experience with the DOE-sponsored plant-wide assessment activity, a typical industrial facility can realize savings of 15 percent or more with little or moderate capital expenditures. In specific energy systems such as steam, process heating, compressed air, and pumps, savings can be 30 percent or higher. These savings can dramatically reduce a company's natural gas and electric bills, directly affecting profits.

Approximately 350,000 manufacturing plants are currently operating in the United States. The challenge is to reach out to as many industrial plants and companies as possible, recognizing that a subset (about 6,000 plants) accounts for nearly half of all manufacturing and mining energy consumption. Replication of energy efficiency technologies and practices is a critical challenge. The results and methodologies used by a specific manufacturing or mining plant to reduce energy costs can frequently be applied to similar plants within that same company and to other plants in that industrial sector. Technology Delivery is a means for reaching out to manufacturers, increasing awareness of the potential benefits of improved energy efficiency, and providing tools and other products and services to help realize these benefits.

### Strategy for Improving Industrial Energy Efficiency

The U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Industrial Technology Program (ITP) leads the federal role in developing advanced energy-efficient and environmentally friendly industrial technologies. Technology Delivery is the outreach and implementation approach for the Industrial Technologies Program. ITP employs the crosscutting industrial area of Technology Delivery to implement near-term, low-cost, system-based energy solutions across each of its IOFs and other energy-intensive industrial sectors such as food processing. Technology Delivery develops, implements, and disseminates best practices in energy management; conducts plant assessments; validates and demonstrates emerging technologies; and encourages corporate energy management strategies.

The strategic objectives of Technology Delivery are:

**Energy Savings** – Through technical assistance in energy management, plant-wide and IAC assessments, and other actions, achieve annual energy savings of:

- 49 trillion Btu by 2005
- 209 trillion Btu by 2010
- 496 trillion Btu by 2020

Technology Delivery is a relatively mature activity within EERE. The strategy has been revised over the past several years to maximize impact. The strategy focuses on the key challenges – creating awareness of the benefits of energy efficiency and the products and services offered by EERE, and reaching as many of the most energy-intensive manufacturers as possible.

**Public-Private Partnerships** – Industry-led collaborations, particularly Allied Partnerships, are the primary means that EERE and Technology Delivery use to increase awareness within industry. Allied Partners help disseminate energy efficiency technologies; promote the use of EERE software tools, training, and information; and encourage technical professionals to participate in qualification training. To maximize its impact, EERE seeks Allied Partners who are large companies, trade associations, or other entities with the capability to reach a large number of end users. Allied Partners sponsor and conduct training on the EERE software tools, distribute tools and communications products, participate in showcases or other energy events, and promote replication of energy-saving activities and results.

**Assessments** – Plant assessments and audits identify opportunities to improve overall operations and the efficiency of plant utility systems. ITP reaches out to energy-intensive manufacturers via two different types of assessments, depending on the size of the company. Competitively awarded, cost-shared, plant-wide assessments target large companies, while IAC assessments target small and medium-sized companies (fewer than 500 employees and less than $2 million in annual energy costs). The 26 Industrial Assessment Centers are distributed across the United States to reach as many companies as possible, with clustering in areas densely populated with industrial manufacturing facilities (Exhibit 4).

Replication of assessment results is essential. Plant-wide assessment awardees are required to deliver a report identifying opportunities, implementation costs, and projected benefits, and must prepare a replication plan for disseminating assessment results to other plants within the company. Using the information in the final report, Technology Delivery develops a case study for dissemination to other companies within that industry (as well as other industries where the results may apply) to achieve additional replication. For IAC audits, companies are not required to prepare reports, but the results are included in the IAC database, which can be accessed through the IAC Web site.

**Exhibit 4**
**Locations of the 26 Industrial Assessment Centers**

**Tool Development** – EERE and industry have collaboratively developed tools addressing major plant utility systems that offer significant energy-savings opportunities. These tools enable companies to self-assess their plant's steam, compressed air, motor, pumping, insulation, and process heating systems. EERE regularly queries its industrial partners to determine if any tools in the existing suite need to be revised and if new tools should be developed. Collaborations among companies, with assistance from professional organizations and national laboratories, lead the development of the tools. The EERE tools emphasize a systems approach to improving efficiency and do not compete with industrial tools already in the marketplace.

**Training** – Training (developed in collaboration with industry champions) helps end users get the full value from EERE software tools and analysis techniques. Awareness and end-user training enable plant managers to identify energy-savings opportunities in specific utility systems or across an entire plant. Qualification training helps industry experts learn the use of EERE tools, thereby giving them the ability to help end users identify energy-savings opportunities. This growing cadre of qualified specialists enables Technology Delivery to reach an increasing number of end users and to beneficially impact increasing numbers of industrial plants.

**Showcase Demonstrations and Energy Events** – Technology showcases and other energy events are a high-profile way to highlight the benefits of energy efficiency and renewable energy technology. By participating in these EERE-wide public events, attendees can see how a comprehensive approach to improving plant operations increases productivity, cost and energy savings, and environmental benefits. Attendees can also observe technologies and practices installed in participating plants and share experiences with other attendees.

**Emerging Technologies and Verification/Validation** – The technology verification and validation (V&V) process represents another mechanism for promoting emerging technologies and demonstrating their technical performance. Demonstration of emerging technologies through cost-shared support facilitates broad industrial acceptance of these new energy-saving technologies, easing their entrance into the marketplace.

**Outreach** – ITP's extensive library of publications on proven energy management practices heightens industry awareness and helps companies achieve immediate energy savings. Technology Delivery has designed a variety of products to meet the needs of different levels of plant personnel, from plant engineers to plant managers and CEOs. The BestPractices, IAC, and Energy Savers Web sites, along with the network of Allied Partners and the ITP Clearinghouse, maintain a steady flow of up-to-date information to manufacturing companies.

**Metrics Development** – The Technology Delivery metrics evaluation methodology is continually refined as field data on actual energy savings attributable to the Technology Development activities are collected. Estimations of the impacts of Technology Delivery on industrial plants are made annually, and the methodology and results are reviewed. A tracking database is used to record activities ranging from attendance at training sessions and other events to distribution of EERE software tools, and other activities that could impact the energy use in industrial facilities.

## Technology Delivery has Identified a Number of Key Activities to Support its Strategic Objectives

**Public-Private Partnerships**

- Sign Allied Partner Agreements with key stakeholders.
- Support actions agreed upon in partnership document.

**Assessments**

- Issue annual plant-wide assessment solicitations, conduct assessments, publish case studies, and develop replication strategies for each assessment.
- Conduct more than 600 IAC assessments in small and medium-sized plants annually.
- Train all IAC directors to become qualified specialists in a minimum of one EERE software tool.
- Improve and restructure the current IAC database to create a Web-based, user-friendly information management system while continuing to manage the expanding body of assessment data.

**Tool Development**

- Continue developing a strategy for creation of new software tools and updates to existing software tools such as MotorMaster+ 4.0.
- Create new tools and update existing tools as needed.

**Training**

- Conduct annual awareness, end-user, and qualified specialist training in collaboration with industrial partners and DOE Regional Offices.
- Continue to expand the cadre of qualified specialists and instructors having a comprehensive knowledge of specific EERE software tools, and encourage application of this knowledge among industry end users.

**Showcases and Energy Events**

- Support showcase events through training sessions, collaborative targeted assessments, and development of case studies.
- Conduct regional/state energy events and awareness workshops to promote replication of energy efficiency and renewable energy technologies.

**Emerging Technologies and Verification/Validation**

- Demonstrate commercial viability of emerging technologies through a verification and validation analysis.

**Outreach**

- Develop materials such as brochures, case studies, CD-ROMs, source books, technical briefs, tip sheets, and the *Energy Matters* newsletter to create awareness of software tools and resources and encourage implementation and replication of energy-efficiency efforts.
- Maintain an updated Web site that supports program outreach efforts, makes Technology Delivery products easily accessible, and keeps industry informed about news and events.
- Develop strategies and actions to reach the 6,000 energy-intensive plants that use 50 percent of the manufacturing and mining energy.

**Metrics Development**

- Evaluate annual energy savings from Technology Delivery activities and extrapolate to future years.
- Record the number of U.S. plants impacted annually by EERE technologies, practices, and software tools.

# FY 2003 HIGHLIGHTS AND ACCOMPLISHMENTS

The accomplishments of Technology Delivery are varied and crosscutting. For example, Allied Partners are involved with training, software tool development, and outreach. The following are highlights and accomplishments for FY 2003:

**Public-Private Partnerships**

- Completed 17 new Allied Partner agreements:
  - Air Perfection, Inc.
  - Air Power of New England
  - Airite, Inc.
  - Aluminum Association
  - American Boilers Manufacturers Association
  - ASM International
  - Atlas Machine and Supply, Inc.
  - Cochrane Compressor Company
  - Council of Industrial Boiler Owners
  - Glass Manufacturing Industry Council
  - Glidepath Holdings, LLC
  - Hanson Aggregates East
  - Industrial Air Centers
  - Institute of Paper Science and Technology
  - Metal Processing Institute
  - Rohm and Haas

(Note: A complete list of Allied Partners is shown in Appendix A)

- Allied Partners conducted a wide variety of activities, including awareness workshops, qualification, and end-user training sessions; distributing EERE information and technologies; and partnering on tool development. Highlights include:
  - Allied Partners sponsored seven out of a total of nine qualification training sessions and 58 out of a total of 77 end-user training sessions.
  - The Compressed Air Challenge updated the *Improving Compressed Air System Performance: A Sourcebook for Industry*; published *Best Practices for Compressed Air Systems Manual*; led an effort to enhance AirMaster+; and completed an evaluation of compressed air training.
  - The Air Movement and Control Association co-published *Improving Fan System Performance: A Sourcebook for Industry* and is actively involved in the development of the fan system assessment tool (FSAT) and the associated end-user and qualified specialist training curricula.
  - The Industrial Heating Equipment Manufacturers reviewed the process heating sourcebook; co-hosted a Process Heating Sensors and Controls Forum and a Materials Forum; and hosted end-user and qualified specialist training sessions.
  - The Hydraulic Institute (HI) expanded member participation in the qualified pump system specialist training; hosted a half-day special session on system efficiency for company CEOs. HI members held a special session to provide feedback on revisions needed to the pump system assessment tool (PSAT).
  - The American Institute of Chemical Engineers led a committee to develop a plant energy-profiling tool.
  - Alcoa has used its involvement with DOE's Plant-wide Assessment initiative as a springboard for the development of its Energy Services' Energy Efficiency program. The savings opportunities identified and methods used by DOE to identify potential savings opportunities became a key part of Alcoa's energy efficiency program. Since initial assessment at the Lafayette plant, Alcoa's energy efficiency network has identified over $50 million in potential energy savings that would result in using 6.5 trillion cubic feet less natural gas and 60,000 MWh less electricity. To date, Alcoa has realized over $10 million of this potential.
  - The Glass Manufacturing Industry Council sponsored and hosted three training workshops.

  - ITT fluid technology has sponsored pumping workshops and participated in discussions to improve the market penetration of the pump system assessment tool. There are currently 15 PSAT qualified specialists.
  - Rohm and Haas participated in the Texas Technology Showcase, the steam steering committee, and the committee for the development of the plant energy profiling tool. As a direct result of a plant-wide assessment, Rohm and Haas has implemented projects that reduced energy consumption by $300,000 per year, including 30 billion Btu/year in fuel savings, and 1,600 MWh/year of electrical power savings. Rohm and Haas then replicated the plant-wide assessment findings at their largest facility in Houston, resulting in over $18.5 million in cost savings per year and 4.25 trillion Btu/year combined fuel and power savings.
  - Spirax Sarco has been very active in distributing EERE steam information, promoting the steam system assessment tool (SSAT), and hosting several training workshops.
  - The Technical Association of the Pulp and Paper Industry conducted a virtual seminar on the systems approach to pumps, compressed air, steam, and process heating, and has sponsored steam training workshops with the Alliance to Save Energy.
- Other Partnership activities include:
  - More than 190 activities recorded in the tracking database
  - More than 7,000 documents requested for distribution
  - Active involvement of the steam and process heating steering committees
  - Collaboration with the International Copper Association on the development of the international motor tool
  - Collaboration with the Alliance to Save Energy on steam initiative communication and outreach

**Assessments**

- Eight plant-wide assessments were completed (final report received):
  - Blue Heron, Oregon City, OR
  - Commonwealth, Urichsville, OH
  - Georgia Pacific, Crossett, AR
  - North Star Steel, Wilton, IA
  - Rohm & Haas, Deer Park, TX
  - Rohm & Haas, Knoxville, TN
  - Weirton Steel, Weirton, WV
  - Weyerhaeuser, Longview, WA
- Plant-wide assessment findings/methodology were replicated at two companies:
  - Alcoa
  - Caraustar
- Technology Delivery completed 691 IAC assessment days, or 612 individual assessments.
- A total of 236 students participated in the IAC initiative.
- The IAC initiative impacted 603 new plants.

**Tool Development**

- Completed development of and released: 1) the Process Heating System Assessment Tool (PHAST), 2) the Steam System Assessment Tool (SSAT), and 3) the Visual Basic version of Steam System Scoping Tool (SSST).
- Initiated beta testing of the NOx tool and the Combined Heat and Power (CHP) tool.
- Continued development of the fan system assessment tool (FSAT) in collaboration with the Air Movement and Control Association and the Plant Energy Profiling Tool (PEPT) in collaboration with Veritech, Inc. These tools will be tested in early FY 2004.

**Training**

- Completed 72 End-User Workshops, with 1,777 end-users trained in best management practices for compressed air, motor, process heating, and steam systems. Training also included use of BestPractices system software tools. Of the 72 workshops, 59 were hosted by Allied Partners with little or no support from Technology Delivery.
- Completed nine Qualified Specialists Workshops, with 64 participants passing the exam to become qualified specialists in the use of a specific software tool.
- Initiated a Web-based overview of the Steam System Assessment Tool (SSAT).

**Showcase and Energy Events - Texas Showcase**

- Conducted plant-wide assessments at Rohm and Haas and Valero. The Rohm and Haas plant-wide assessment was completed, and an annual savings of over 2.1 trillion Btu (about $7.7 million) was identified.
- Held four training sessions, one each for pumps, steam, air, and process heating.
- Conducted three collaborative targeted assessments at Valero (air, process heating, and steam) and two were done at Chevron Phillips (air and steam). The total annual savings identified was 677 billion Btu of natural gas and 10 MWh/yr of electricity, for a combined savings of about $3.3 million.

**Showcase and Energy Events - Nevada Energy Event**

- Technology Delivery conducted two collaborative targeted assessments at Anglo Gold (air and process heating), two at Barrick (air and process heating), two at Newmont (process heating and sensors and controls), and two at Placer Dome (process heating, and sensors and controls). The total annual savings identified was 573 billion Btu of natural gas and 10 MWh/yr of electricity, for a combined savings of about $3.3 million.
- Held several training sessions in FY 2002. None were held in FY 2003.

**Emerging Technologies and Verification and Validation (V&V)**

- The following projects that were awarded under the Emerging Technologies Deployment solicitation issued in FY 2000 (which included a V&V component) were continued:
  - Multi-Partner Demonstration of Energy-Efficient and Environmentally Improved Methods for the Production of Polyurethane Foam (Air Products)
  - Production of Line Field Test of In-line, Fluidized Bed, Rapid Heat Treatment System (Amcast Industrial Corporation)
  - Large-Scale Evaluation of Nickel Aluminide Rolls in a Heat-Treating Furnace at Bethlehem Steel's Burns Harbor Plate Mill (Bethlehem Steel Corporation)
  - Improving Taconite Processing Plant Efficiency by Computer Simulation (Ispat Inland Mining Company)
- V&V evaluations for the following projects were initiated:
  - Mill-wide Advanced Quality Control System (Augusta Newsprint)
  - Development of the Pilot Plant for Field Test of Low-Temperature Plasma Technologies for Treating Volatile Organic Compound Emissions from Pulp Mills and Wood Products Plants (Georgia Pacific)
  - Process Heater Ultra Low Air Control Industrial Air Centers (Valero)
  - Multi-Partner Demonstration of Energy-Efficient and Environmentally Improved Methods for the Production of Polyurethane Foam (Air Products)
  - Production of Line Field Test of In-line, Fluidized Bed, Rapid Heat Treatment System (Amcast Industrial Corporation)

- Large-Scale Evaluation of Nickel Aluminide Rolls in a Heat-Treating Furnace at Bethlehem Steel's Burns Harbor Plate Mill (Bethlehem Steel Corporation)
- Improving Taconite Processing Plant Efficiency by Computer Simulation (Ispat Inland Mining Company)

**Outreach**

- Issued more than 50 new outreach documents:
  - 18 case studies (14 for plant-wide assessments)
  - 11 plant-wide assessment summaries
  - 5 software tool fact sheets and one steam overview fact sheet
  - 3 new CD-ROMs
  - 1 new sourcebook on fans
  - 4 steam technical briefs
  - 4 quarterly issues of the *Energy Matters* newsletter and four editions of *Energy Matters Extra*, its on-line complement
  - 6 bi-monthly issues of *Steaming Ahead* electronic newsletter
- Distributed more than 36,000 copies of BestPractices communications products.
- Documented more than 800,000 page views, more than 1 million file downloads, and more than 1 million PDF downloads from the BestPractices and IAC Web sites.
- Created the Energy Savers Web site.
- Conducted 11 steam awareness workshops, with participation by over 272 unique facilities and over 574 attendees.
- Provided technical assistance to more than 1,500 clients through the ITP Clearinghouse.
- Participated in the Texas Technology Showcase, the Mining Energy Solutions event, and the Saving Water event in Denver.
- Initiated two projects in conjunction with the Alliance to Save Energy:
  - In partnership with the New York State Energy Research and Development Association, Technology Delivery will determine if delivering energy management at the corporate level will increase the adoption of energy efficiency technologies and practices.
  - In partnership with the State of Maryland, Technology Delivery will establish a network of representatives from industries, utilities, and the State Energy Office to galvanize resources and focus these resources on reducing energy consumption in Maryland industries, with emphasis on aluminum, chemicals, and forest products.

**Metrics Development**

- Plant-wide assessments (excluding IAC assessments), use of software tools, training, and technical assistance saved an estimated 81 trillion Btu (more than $400 million) in FY 2002, according to metrics analyses conducted in FY 2003.
- IAC assessments saved an estimated 1 trillion Btu (worth $7 million) and $15 million in non-energy operating costs in FY 2002.
- Technology Delivery actions impacted about 1,200 new plants.
- Energy savings in FY 2003 are expected to be similar to those in FY 2002, about 80 trillion Btu.

# TOOLS, PUBLICATIONS, AND RESOURCES AVAILABLE

EERE offers valuable tools and publications to help industrial companies improve productivity and energy efficiency. Some of these resources are described below. See the Web site at http://www.ee.energy.gov/industry/bestpractices.shtml for a complete listing. Tools may be ordered via e-mail from clearinghouse@ee.doe.gov or by calling the Clearinghouse at 800-862-2086.

**Tools**

- ASDMaster: Adjustable Speed Drive Evaluation Methodology and Application
- AIRMaster+
- MotorMaster+ 4.0
- Process Heating Assessment and Survey Tool (PHAST)
- Pumping System Assessment Tool (PSAT)
- Steam System Assessment Tool (SSAT 1.0.0)
- Steam System Scoping Tool
- 3E Plus, Version 3.2
- Decision Tools for Industry (CD), which contains MotorMaster+ 4.0, PSAT, Steam System Scoping Tool, 3E Plus, and AIRMaster+

**Case Studies**

- Plant-Wide Assessment Case Studies
  - Aluminum
  - Chemicals
  - Forest Products
  - Glass
  - Metal Casting
  - Mining
  - Petroleum
  - Plant-wide Assessment Summaries
- Case Studies by Industry
  - Aluminum
  - Chemicals
  - Forest Products
  - Glass
  - Metal Casting
  - Mining
  - Petroleum
  - Steel
  - Other Industries
- Case Studies by Industrial System
  - Compressed Air
  - Motors
  - Process Heating
  - Pumping Systems
  - Steam
  - Multiple Systems
  - Other Systems
- Management Case Studies

**Source Books**

- *Improving Fan System Performance: A Sourcebook for Industry*
- *Improving Steam System Performance: A Sourcebook for Industry*
- *Improving Compressed Air System Performance: An Industry Sourcebook*
- *Improving Pumping System Performance: A Sourcebook for Industry*

**Other Publications**

- Technical Fact Sheets and Handbooks including Technical Briefs and Guides
- Tip Sheets
- Market Assessments
- Repair Documents

**Databases**

- Industrial Assessment Center (IAC) Database
- National Inventory of Manufacturing Assistance Programs (NIMAP)

# HOW TO GET INVOLVED AND CONTACT INFORMATION

## Partnership Information

Public-private partnerships are the foundation of ITP's technology delivery strategy. ITP includes its partners in every phase of the technology development process to focus scarce resources where they can have the greatest impact on industrial energy efficiency. To learn more, please visit our Web site at www.eere.energy.gov/industry.

- Collaborative, **cost-shared research and development** projects are a central part of ITP's strategy. Annual solicitations provide technology development opportunities in a variety of energy-intensive industries.

- **Industries of the Future Partnerships** increase energy efficiency in the most energy-intensive industries. In addition to cost-shared research and development projects, industry partners participate in the development of vision and roadmap documents that define long-term goals, technology challenges, and research priorities.

- **Allied Partnerships** provide an opportunity for ITP to reach a broad audience of potential customers by allying with corporations, trade associations, equipment manufacturers, utilities, and other stakeholders to distribute industrial energy efficiency products and services. By becoming an Allied Partner, an organization can increase its value to clients by helping them achieve plant efficiencies.

- **State energy organizations** work with ITP in applying technology to assist their local industries. ITP assists states in developing IOF partnerships to mobilize local industries and other stakeholders to improve energy efficiency through best practices, energy assessments, and collaborative research and development.

- **EERE's technical programs** (of which ITP is one of eleven) give manufacturers access to a diverse portfolio of energy efficiency and renewable energy technologies and bring advanced manufacturing technology to the renewable energy community. For more information, access the EERE home page at www.eere.energy.gov.

- The President's **Climate VISION** (Voluntary Innovative Sector Initiatives: Opportunities Now) effort also offers opportunities for manufacturers to pursue cost-effective actions that will reduce greenhouse gas emissions. See www.climatevision.gov for details.

## Access to Resources and Expertise

The Industrial Technologies Program provides manufacturers with a wide variety of industrial energy efficiency resources to help your company cut energy use right away. Visit our site at www.eere.energy.gov/industry or call the EERE Information Center at 877-337-3463 to access these resources and for more information.

- ITP offers **energy management best practices** to improve energy efficiency throughout plant operations. Improvements to industrial systems such as compressed air, motors, process heat, and steam can yield enormous savings with little or no capital investment.

- Our suite of powerful system optimization **software tools** can help plants identify and analyze energy-saving opportunities in a variety of systems.

- **Training sessions** are held several times per year at sites across the country for companies interested in implementing energy-saving projects in their facilities. DOE software tools are used as part of the training sessions.

- ITP's qualified **industrial energy specialists** will work with your plant personnel to identify savings opportunities and train staff in the use of ITP software tools.

- Our extensive library of **publications** gives companies the resources they need to achieve immediate energy savings.

- **Plant-wide energy assessments** are available to manufacturers of all sizes interested in cutting their energy use. Cost-shared solicitations are available each year for plant-wide energy assessments. In addition, no-cost, targeted assessments are provided to eligible facilities by teams of engineering faculty and students from 26 university-based Industrial Assessment Centers around the country.

- The **DOE Regional Offices** provide a nation-wide network of capabilities for implementing ITP's technology delivery strategy. Regional Offices are located in Atlanta, Boston, Chicago, Denver, Philadelphia, and Seattle. Visit www.eere.energy.gov/rso.html for more information.

## Where to Go for More Information

**Visit the Web sites** - www.eere.energy.gov/bestpractices; www.eere.energy.gov/iac

**Learn about all EERE programs** - www.eere.energy.gov

**Ask an Expert** - The Industrial Technologies Clearinghouse is a great way to access the program's resources and a great source for technical assistance and software tool support. Contact the clearinghouse between 9 a.m. to 8 p.m. EST (6 a.m. to 5 p.m. PST).
Phone: 1-800-862-2086
Fax: 360-956-2214
E-mail: clearinghouse@ee.doe.gov

**For print copies of DOE, EERE, and ITP Publications, contact** -
Energy Efficiency and Renewable Energy Clearinghouse (EREC)
P.O. Box 3048
Merrifield, VA 22116
Fax: 703-893-0400
Phone: 1-800-363-3732
E-mail: doe.erec@nciinc.com

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E-mail: sandy.glatt@ee.doe.gov

# APPENDIX A: EERE ALLIED PARTNERS

### BestPractices Allied Partners

A&M Compressed Air Products
Accurate Air Engineering, Inc.
Air Equipment, Inc.
Air Movement and Control Association International, Inc. (AMCA)
Air Perfection, Inc.
Air Power of New England
Air Power of USA, Inc.
Air Science Engineering, Inc.
Air System Management, Inc.
Airite, Inc.
Alcoa, Inc.
Aluminum Association, Inc.
American Boiler Manufacturing Association (ABMA)
American Institute of Chemical Engineers (AIChE)
Arrow Pneumatics, Inc.
ASM International
Atlas Machine and Supply, Inc.
Burgmann Seals America
Cal Supply Company, Inc.
Cochrane Compressor Company
Compressed Air & Gas Institute (CAGI)
Compressed Air Challenge, Inc.
Compressed Air Management, Inc.
Compressed Air Systems, Inc.
Compressor Distributors Association (CDA)
Council of Industrial Boiler Owners (CIBO)
domnick hunter, Inc.
Draw Professional Services
Energy Machinery, Inc.
Energy Solutions Center
Engineering Sales Associates
Fairbanks Morse
Flowserve Corporation
FMC Corporation
Forging Industry Association
Glass Manufacturing Industry Council (GMIC)
Glauber Equipment Corporation
Glidepath Holdings LLC
Hanson Aggregates East
Hydraulic Institute
HydroAire, Inc.
I & M Industries, Inc.
Industrial Air Centers
Industrial Heating Equipment Association (IHEA)
Institute of Paper Science and Technology (IPST)
Iron and Steel Society
ITT Fluid Technology
John R. Wald Company, Inc.
Kaeser Compressors
Metal Powder Industries Federation
Metal Processing Institute
Millenium Chemicals, Inc.
National Association of State Energy Officials (NASEO)/Association of State Energy Research and Technology Transfer Institutions (ASERTTI)
National Insulation Association (NIA)
Pneumatic/ConservAIR Technologies Company
Power Supply Industries
Remco Equipment Company
Rogers Machinery Co.
Rohm & Haas Company
Sacramento Municipal Utility District
Scales Air Compressor Corporation
Secat, Inc.
Society of the Plastics Industry, Inc.
Spirax-Sarco, Inc. (SSI)
Sterling Fluid Systems (USA), Inc.
Strategic Air Concepts
Technical Association of the Pulp & Paper Industries (TAPPI)
Tide Air, Inc.
UE Systems, Inc.
Weir Specialty Pumps

## Motor Challenge Allied Partners

Advanced Energy Corporation
Ameren Services
American Electric Power
American Water Works Association
Applied Industrial Technologies
Applied Proactive Technologies, Inc.
ASDtech Associates
Association of Facilities Engineers
Austin Energy
Baker Instrument Company
Baldor Electric Company
BJM Corporation
Bonneville Power Administration
Brithinee Electric
Building Controls & Services, Inc.
Burlington Electric Department
CEC Consultants, Inc.
Chelan County P.U.D No. 1
City Utilities of Springfield
Clark Public Utilities
Colorado Springs Utilities
Consortium for Energy Efficiency, Inc.
Copper Development Association, Inc.
Delaware Manufacturing Extension Partnership
Dreisilker Electric Motors, Inc.
Eastland Industries, Inc.
Electric Enterprise, Inc.
Electric League of the Pacific Northwest
Electric Motor Supply, Inc.
Electric Motors & Drives, Inc.
Electrical Apparatus Service Association
ElectriCities of North Carolina
Emerson Electric/Dayton Motors
Energy Center of Wisconsin
Ensave Energy Performance, Inc.
Entergy Corp.
Etc Group, Inc.
Fiolo Corporation
Florida Power & Light Company
Gainesville Regional Utilities
GE Industrial Control Systems
General Electric Corporation
Georgia Power Company
Hawaiian Electric Company
Hayes & Lunford Electric Motor Repair, Inc.
HECO, Inc.
Holzer Energy Management Company
Honeywell DMC Services, Inc.
HIS Electric, Inc.
HydroTech Services, Inc.
IBT, Inc.
Industrial Supplies, Inc.
J & R Consulting, Inc.
Kalen Electric and Machinery Co., Inc.
Kaman Industrial Technologies
Longo Industries
Lower Colorado River Authority
MagnaDrive Corporation
MEAG Power
Meier Transmission, Ltd.
Mississippi Power Company
Motion Industries, Inc.
Motor Technology, Inc.
National Electric Motor & Supply Company
New York State Energy R&D Authority
North Carolina A&T State University
North Carolina State University
Northeast Energy Efficiency Partnerships, Inc.
Northeast Utilities Service Company
Northwest Energy Education Institute
Northwest Energy Efficiency Alliance
Ohio Department of Development/Energy Efficiency
Osborn Engineering Company
Pacific Gas and Electric Corporation
PEPCO Service, Inc.
Planergy International, Inc.
Productive Energy Solutions, LLC
Progressive Maintenance Technologies
PWI Energy
Reading Electric
Rockwell Automation
Rural Electric Cooperative, Inc.
Shoemaker Industrial Solutions
SM Service & Technology
Snohomish County PUD
Southern California Edison
Southern Minnesota Municipal Power Authority
Stanco Power Systems, Inc.
Sterling Energy Services, Inc.
Tampa Electric Company
Technology Resources & Development Corporation (TRD)
TechSOLVE, Inc.
Tennessee Tech University
United Electric Supply
University of Alabama in Huntsville
Western Area Power Administration

## A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and great energy independence for America. By investing in technology breakthroughs today, our nation can look forward to a more resilient economy and secure future.

Far-reaching technology changes will be essential to America's energy future. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a portfolio of energy technologies that will:

- Conserve energy in the residential, commercial, industrial, government, and transportation sectors
- Increase and diversify energy supply, with a focus on renewable domestic sources
- Upgrade our national energy infrastructure
- Facilitate the emergence of hydrogen technologies as a vital new "energy carrier"

## The Opportunities

*Biomass Program*
Using domestic, plant-derived resources to meet our fuel, power, and chemical needs

*Building Technologies Program*
Homes, schools, and businesses that use less energy, cost less to operate, and ultimately, generate as much power as they use

*Distributed Energy & Electric Reliability Program*
A more reliable energy infrastructure and reduced need for new power plants

*Federal Energy Management Program*
Leading by example, saving energy and taxpayer dollars in federal facilities

*FreedomCAR & Vehicle Technologies Program*
Less dependence on foreign oil, and eventual transition to an emissions-free, petroleum-free vehicle

*Geothermal Technologies Program*
Tapping the Earth's energy to meet our heat and power needs

*Hydrogen, Fuel Cells & Infrastructure Technologies Program*
Paving the way toward a hydrogen economy and net-zero carbon energy future

*Industrial Technologies Program*
Boosting the productivity and competitiveness of U.S. industry through improvements in energy and environmental performance

*Solar Energy Technology Program*
Utilizing the sun's natural energy to generate electricity and provide water and space heating

*Weatherization & Intergovernmental Program*
Accelerating the use of today's best energy-efficient and renewable technologies in homes, communities, and business

*Wind & Hydropower Technologies Program*
Harnessing America's abundant natural resources for clean power generation

To learn more, visit www.eere.energy.gov

## Technology Delivery

***Industrial Technologies Program***
**Boosting the productivity and competitiveness of U.S. industry**

**U.S. Department of Energy**
**Energy Efficiency and Renewable Energy**

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